

Work Order ID 61509

Monday, August 30, 2010 9:00:53 AM



Page 1

Item ID: D407-667-105TRN

Accept



Setup Start



Revision ID:

Stop



Item Name: Crosstube Turning Detail

Start Date: 8/30/2010 Start Qty: 1.00



Cust Item ID:

Required Date: 9/6/2010 Req'd Qty: 1.00



Customer:

Reference:

Approvals:

Process Plan: PLDate: 10-8-30

Tooling:

Date:

Run Start



QC:

Date:

SPC (Y/N):

Date:

Stop

Sequence ID/
Work Center IDOperation
DescriptionSet Up/
Run Hours

Tool ID

Tool #

Plan
CodeAccept
QtyReject
QtyReject
NumberInsp.
Stamp

Draw Nbr

Revision Nbr

D407-667-145

Rev C

100

0.00



MORI SEIKI CNC LATHE LARGE

Mori Seiki

Memo

0.00

Mori Seiki CNC Lathe Large

1-Fill tube with sand & install plugs DT8673 on both ends as per Folio
FA249□2-Turn first side as per Folio FA249□3- File transition lines smooth.

G.M. 10-09-076

110

0.00



QC1- Inspect dimensions to dimension sheet

QC

Memo

0.00

Quality Control

G.M. 10-09-070

120

0.00



MORI SEIKI CNC LATHE LARGE

Mori Seiki

Memo

0.00

Mori Seiki CNC Lathe Large

1-Turn second side as per Folio FA249□2- File transition lines smooth.□3-
Remove sand and plugs□4-Scribe part # and batch # using vibrating stylus as
per Dwg D206-667-145 □Inside of Cuff(Do not engrave on outside of tube)

G.M. 10-09-07①

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: D407-667-105TRN PAR #: _____ Fault Category: x-tubes NCR: Yes No DQA: ✓ Date: 10/09/15
 Resolution: Accepted Disposition: use as is. QA: N/C Closed: ✓ Date: 10/09/15

NCR: <u>61509</u>		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
10.09.13	100	Tube O.D.'s ARE UNDER TOL. 2.40 offset slightly off.	CP 10.09.13 (PS) 042	Acceptable. REF ATTACHED SR	CP 10-09-13	S 10/09/13	CP 10.09.13 (PS) 042	S 10/09/13

NOTE: Date & initial all entries

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Page 2

Item ID: D407-667-105TRN

Accept



Setup Start



Revision ID:

Stop



Item Name: Crosstube Turning Detail

Start Date: 8/30/2010 Start Qty: 1.00



Cust Item ID:

Required Date: 9/6/2010 Req'd Qty: 1.00



Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____




Run Start



QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop



Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
130	QC1- Inspect dimensions to dimension sheet	0.00							
									
QC	Memo	0.00							
Quality Control									
140	QC8- Inspect parts - second check	0.00							
									
QC	Memo	0.00							
Quality Control									
150	Crosstubes Chemical Conversion	0.00							
									
HandFXtube	Memo	0.00							
Hand Finishing Crosstubes									

A.M. 10-09-07 @

SAD 10/09/13

④

SAD 10-09-13

④

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

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Work Order ID 61509

Monday, August 30, 2010 9:00:53 AM



Page 3

Item ID: D407-667-105TRN

Accept



Setup Start



Revision ID:

Stop



Item Name: Crosstube Turning Detail

Start Date: 8/30/2010 Start Qty: 1.00



Cust Item ID:

Required Date: 9/6/2010 Req'd Qty: 1.00



Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Run Start



QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop

Sequence ID/
Work Center IDOperation
DescriptionSet Up/
Run Hours

Tool ID

Tool #

Plan
CodeAccept
QtyReject
QtyReject
NumberInsp.
Stamp

160

QC3- Inspect Part Finish

0.00



QC

Memo

0.00

Quality Control

(IX) MB 10-09-14

170

Packaging

0.00



Packaging

Memo

0.00

Packaging

Identify and stock in Kanban rack Location: X-tube cul

(IX) MB 10-09-14

180

QC21- Final Inspection - Work Order Release

0.00



QC

Memo

0.00

Quality Control

10/09/14
ME
10-9-14

W/O:		WORK ORDER CHANGES					
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Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

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			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries

Picklist Print

Monday, August 30, 2010 9:00:57 AM

Page 1

Work Order ID: 61509

Parent Item: D407-667-105TRN

Parent Item Name: Crosstube Turning Detail


Start Date: 8/30/2010

Required Date: 9/6/2010

Start Qty: 1.00

Required Qty: 1.00

Comments: IPP Rev:a 08.02.28 new issue EC
IPP Rev B 08.04.02 Removed polish EC verified by: DD

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6010-115  Crosstube Material		Manufactured	No			110	Each	43.0000	1	1			

MB 10-09-02

Location

Loc Qty

Loc Code

LG

43

26424

2

38343

41

IX

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

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NOTE: Date & initial all entries

DART AEROSPACE LTD	Work Order: 61509
Description: Crosstube Assembly	Part Number: D407-667-145
Inspection Dwg: D407-667-145 Rev: C	Page 1 of 1

FIRST ARTICLE INSPECTION CHECKLIST

☒ First Article ☐ Prototype

	Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+0.005/-0.000	2.230	✓		Vern. 0.001	
	1.865	+0.005/-0.000	1.856	✓			
	1.878	+0.005/-0.000	1.870	✓			
	1.970	+0.005/-0.000	1.965	✓			
	2.030	+0.005/-0.000	2.024	✓			
	2.165	+0.005/-0.000	2.165	✓			
	0.125	+/-0.010	0.125	✓			
	R0.063	+/-0.010	R0.063	✓			
	R0.500	+/-0.010	R0.500	✓			
	R0.063	+/-0.010	R0.063	✓			
	4.438	+/-0.010	4.438	✓			
SIDE B	2.240	+0.005/-0.000	2.230	✓		Vern. 0.001	
	1.865	+0.005/-0.000	1.856	✓			
	1.878	+0.005/-0.000	1.870	✓			
	1.970	+0.005/-0.000	1.965	✓			
	2.030	+0.005/-0.000	2.024	✓			
	2.165	+0.005/-0.000	2.165	✓			
	0.125	+/-0.010	0.125	✓			
	R0.063	+/-0.010	R0.063	✓			
	R0.500	+/-0.010	R0.500	✓			
	R0.063	+/-0.010	R0.063	✓			
	4.438	+/-0.010	4.438	✓			
	113.20	+/-0.020	113.200	✓			

Measured by: A.M.
Date: 10.09.07

Audited by: S
Date: 10/09/13

Prototype Approval:	N/A
Date:	N/A

Rev	Date	Change	Revised by	Approved
A	04.04.21	New Issue (P/O D407-667-105)	KJ/RF	
B	06.03.09	Dwg Rev updated	KJ/JLM	
C	09.06.11	Dwg Rev updated	KJ	

W/O:		WORK ORDER CHANGES					
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NOTE: Date & initial all entries

Item	Qty -145	Part Number	Description
1	X	D407-667-145	CROSSTUBE ASSEMBLY (407 HIGH FWD)
2	1	D6010-115	CROSSTUBE
3	2	D2873-043	NUT PLATE
4	2	D2873-045	NUT PLATE
5	2	D2891-1	SUPPORT
6	4	D3595-063-395	RUBBER CUSHION
7	4	MS21920-20	CLAMP (OR MS21920-21)
8	14	MS20601AD4W10	RIVET (OR NAS9302B-4-10)
9	A/R	MAGNOBOND 6398	ROCKWELL SPECIFICATION RBO-120-023 ADHESIVE (TEXTRON/BELL SPEC. 299- 947-100, TYPE II, CLASS 2 ADHESIVE)

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6010-115
FINISHED LENGTH = 113.20±0.020
- 2) FINISH: CHEMICAL CONVERSION COAT PER DART QSI 005 4.1
PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED.
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: SCRIBE DART PART NUMBER "D407-667-145" AND BATCH NUMBER ON INSIDE OF CUFF USING VIBRATING STYLUS.
- 7) WEIGHT: 17.8 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE.
- 9) RUN CUTTER OFF PART WHERE INDICATED. BLEND OUT EDGE LONGITUDINALLY. TRANSITION SHOULD BE SMOOTH.
- 10) BEND PROGRESSIVELY WITH A MINIMUM OF 6 PASSES. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D.
- 11) LIQUID PENETRANT INSPECT OUTSIDE SURFACE OF CROSSTUBE PER QSI 038.
- 12) INSTALL D2891-1 SUPPORT USING 0.03" TO 0.06" THICK LAYER OF MAGNOBOND 6398 PER QSI 015. LET CURE FOR 12 HOURS AFTER INSTALLATION AND PRIOR TO PACKAGING.
- 13) INSTALL MS21920-20 CLAMPS (OR -21) WITH D3595-063-395 RUBBER CUSHIONS TO SECURE THE D2891-1 SUPPORT ON TOP SIDE OF THE CROSSTUBE. ENSURE CLAMP MECHANISMS ARE LOCATED ON CROSSTUBE SUPPORTS.
- 14) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE.
- 15) TO TORQUE CLAMPS 80 TO 100 IN-LB. ENSURE AT LEAST 1.5 THREADS ARE SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING.

SHOP COPY
RETURN TO
ENGINEERING
UNCONTROLLED COPY
SUBJECT TO AMENDMENT
WITHOUT NOTICE
WORK ORDER
NO. 61509
BS 10-8-30

RELEASED
08/11/06

C	REVISE GENERAL NOTES/PART LIST (ZN D7-1); REORGANIZED VIEWS AND REFORMATTED DRAWING TO CURRENT STANDARDS. D3595-063-395 WAS D2856-400-694 (ZN D6-2 & A5-2); REMOVED REF. 7 ADD TOLERANCES (ZN C6-3, C4-3, D2-3); RELOCATED FLAG #8 (ZN A8-3) PER NCR 210; MOVED TURNING DETAIL & UPDATED TOLERANCE TO SHEET 4.	RF	08.11.06
B	ADD HOLES AND NUT PLATES FOR COMPATABILITY WITH BHTAA SKUDTUBES	PH	05.07.26
A	NEW ISSUE	CP	02.05.08
REV.	DESCRIPTION	BY	DATE
DESIGN	<u>RF</u>	DART AEROSPACE LTD	
DRAWN	<u>RF</u>	HAWKESBURY, ONTARIO, CANADA	
CHECKED	<u>RF</u>	DRAWING NO.	REV. C
MFG. APPR.	<u>RF</u>	D407-667-145	SHEET 1 OF 4
APPROVED	<u>RF</u>	TITLE	SCALE
DE APPR.	<u>RF</u>	CROSSTUBE ASS'Y (407 HIGH FWD)	NTS
DATE	08.11.06	COPYRIGHT © 2002 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR REPRODUCED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	

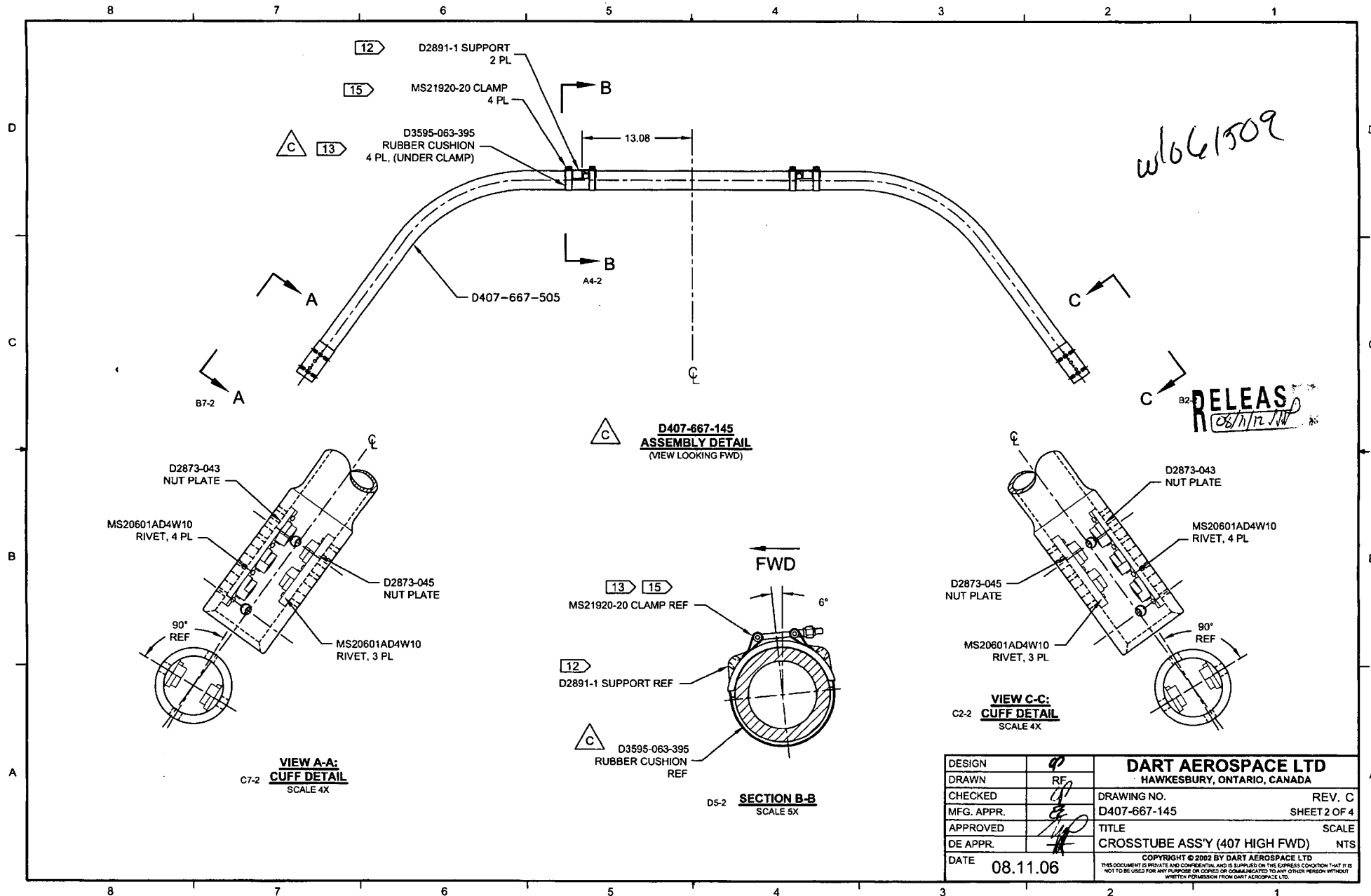
W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

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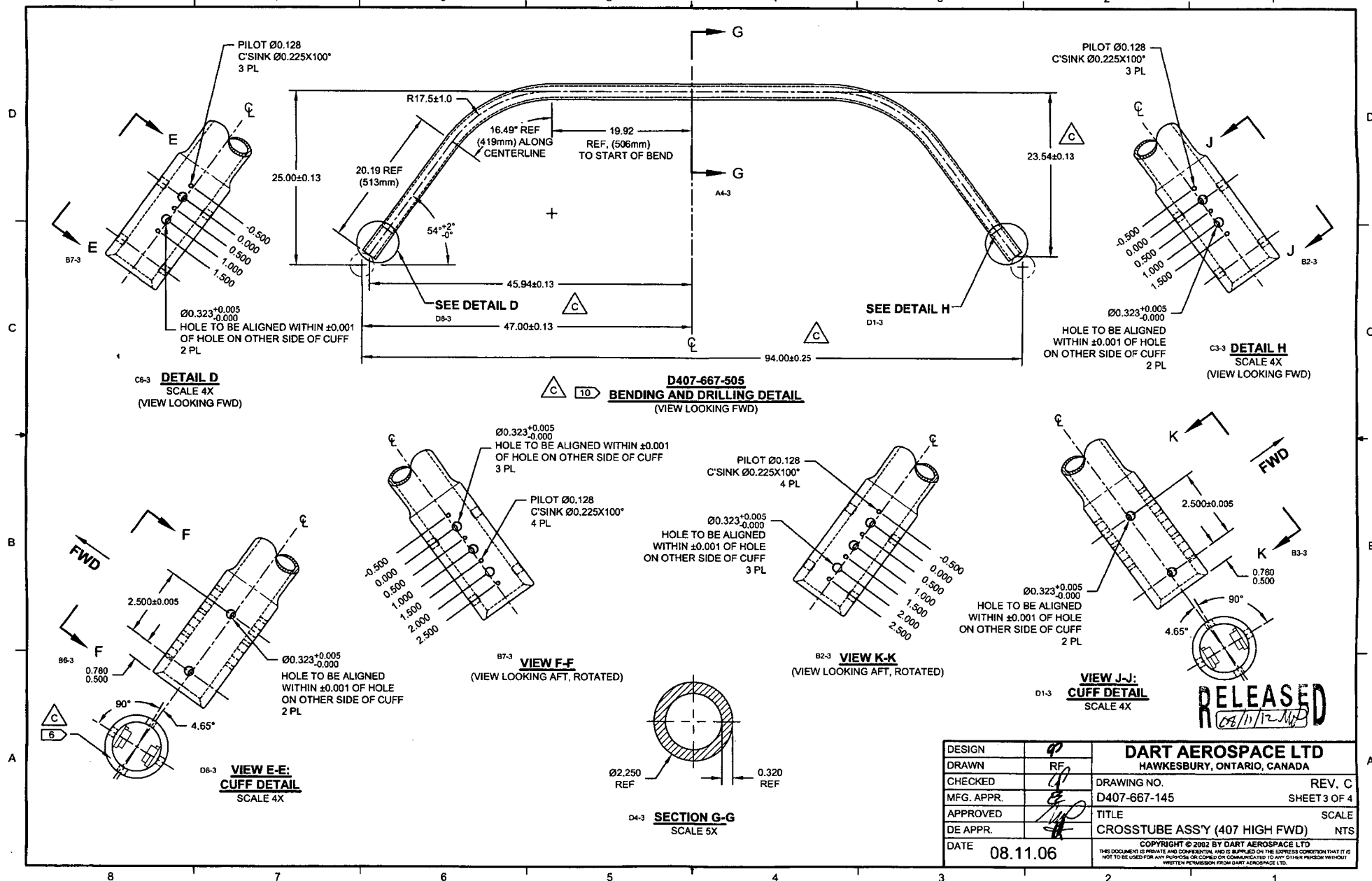
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W/O 661509



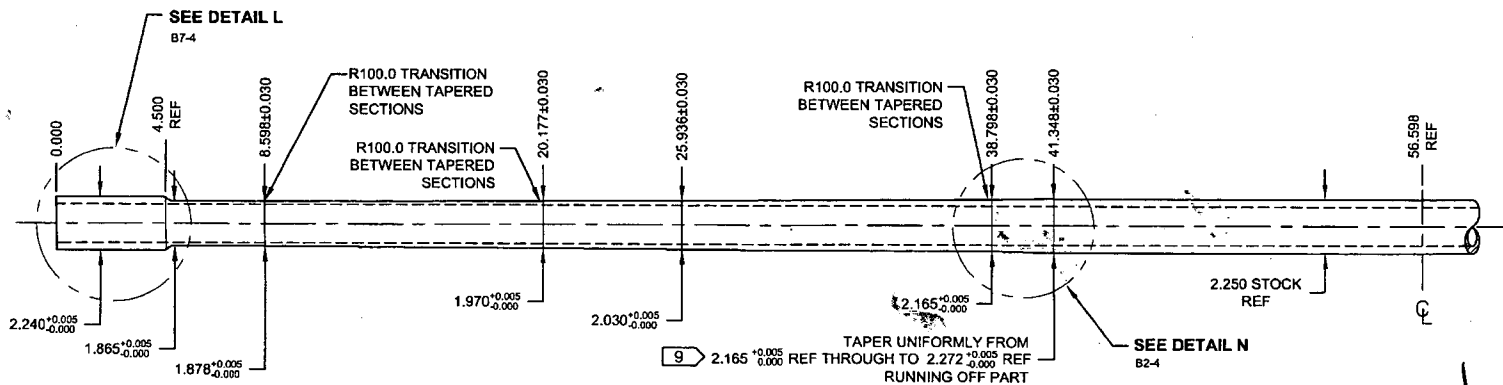
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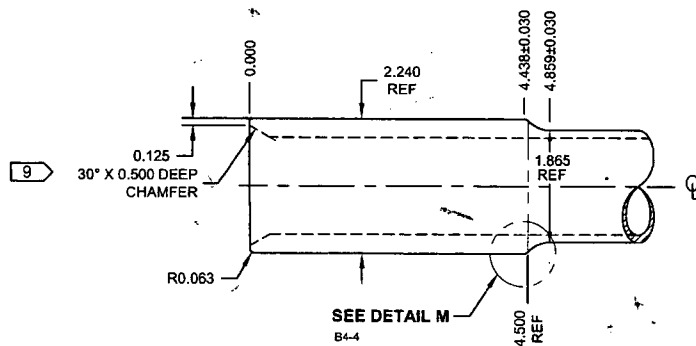
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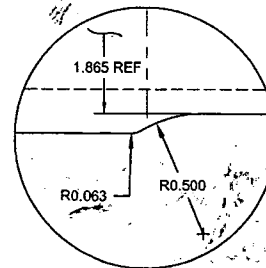


wlc61509

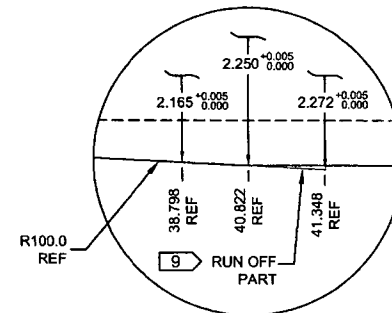
C TURNING DETAIL



**DETAIL L:
CROSSTUBE CUFF**
NOT TO SCALE



**DETAIL M:
CUFF TRANSITION**
NOT TO SCALE



**DETAIL N:
TAPER RUN-OFF**
NOT TO SCALE

RELEASED
08/11/06

DESIGN	92	DART AEROSPACE LTD	
DRAWN	RF	HAWKESBURY, ONTARIO, CANADA	
CHECKED	92	DRAWING NO.	REV. C
MFG. APPR.	92	D407-667-145	SHEET 4 OF 4
APPROVED	92	TITLE	SCALE
DE APPR.	92	CROSSTUBE ASS'Y (407 HIGH FWD)	NTS
DATE	08.11.06	COPYRIGHT © 2002 BY DART AEROSPACE LTD	
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NOTE: Date & initial all entries

FROM SR-D407-667-1 Rev. A

FOR D407-667-145

SECTION	Cross tube	Damage Tolerance	O.D. (in)	I.D. (in)	Area (in ²)	Inertia (in ⁴)
A-A	Bell Fwd	0.000	2.250	1.610	1.940	0.928
	Bell Fwd w/ dam. tol.	0.005			1.935	0.922
	Dart Fwd	0.000	2.250	1.610	1.940	0.928
	Dart Fwd w/ dam. tol.	0.015			1.833	0.876
B-B	Bell Fwd	0.000	2.193	1.610	1.741	0.806
	Bell Fwd w/ dam. tol.	0.005			1.736	0.800
	Dart Fwd	0.000	2.165	1.610	1.646	0.749
	Dart Fwd w/ dam. tol.	0.015			1.538	0.697
C-C	Bell Fwd	0.000	2.035	1.610	1.217	0.512
	Bell Fwd w/ dam. tol.	0.005			1.212	0.507
	Dart Fwd	0.000	2.024	1.610	1.182	0.494
	Dart Fwd w/ dam. tol.	0.012			1.078	0.445
D-D	Bell Fwd	0.000	1.975	1.610	1.028	0.417
	Bell Fwd w/ dam. tol.	0.005			1.023	0.412
	Dart Fwd	0.000	1.965	1.610	0.997	0.402
	Dart Fwd w/ dam. tol.	0.012			0.893	0.354
E-E	Bell Fwd	0.000	1.876	1.610	0.728	0.278
	Bell Fwd w/ dam. tol.	0.005			0.723	0.274
	Dart Fwd	0.000	1.870	1.610	0.711	0.270
	Dart Fwd w/ dam. tol.	0.012			0.607	0.226
F-F	Bell Fwd	0.000	1.858	1.610	0.675	0.255
	Bell Fwd w/ dam. tol.	0.005			0.670	0.251
	Dart Fwd	0.000	1.856	1.610	0.670	0.253
	Dart Fwd w/ dam. tol.	0.012			0.566	0.209
G-G	Bell Fwd	0.000	2.250	1.610	1.940	0.928
	Bell Fwd w/ dam. tol.	0.005			1.935	0.922
	Dart Fwd	0.000	2.230	1.610	1.870	0.884
	Dart Fwd w/ dam. tol.	0.030			1.748	0.813

SECTION	Cross tube	Bending Ultimate (lb*in)	Bending Yield (lb*in)	Tension Ultimate (lb)	Tension Yield (lb)	Shear Ultimate (lb)
A-A	Bell fwd w/ DT	54085	45891	127726	108374	81280
	Dart fwd w/ DT	59941	51723	141158	120992	75162
	Margin of Safety	0.11	0.13	0.11	0.12	-0.08
B-B	Bell fwd w/ DT	48124	40832	114599	97235	72926
	Dart fwd w/ DT	49601	42812	118463	101539	63077
	Margin of Safety	0.03	0.05	0.03	0.04	-0.14
C-C	Bell fwd w/ DT	32876	27895	79971	67854	50891
	Dart fwd w/ DT	33648	29229	82974	71120	44181
	Margin of Safety	0.03	0.05	0.04	0.05	-0.13
D-D	Bell fwd w/ DT	27547	23373	67499	57272	42954
	Dart fwd w/ DT	27728	23950	68741	58921	36602
	Margin of Safety	0.01	0.02	0.02	0.03	-0.15
E-E	Bell fwd w/ DT	19264	16345	47737	40504	30378
	Dart fwd w/ DT	18628	16070	46708	40035	24870
	Margin of Safety	-0.03	-0.02	-0.02	-0.01	-0.18
F-F	Bell fwd w/ DT	17822	15122	44253	37548	28161
	Dart fwd w/ DT	17307	14931	43553	37331	23191
	Margin of Safety	-0.03	-0.01	-0.02	-0.01	-0.18
G-G	Bell fwd w/ DT	54085	45891	127726	108374	81280
	Dart fwd w/ DT	56148	48783	134584	115358	71662
	Margin of Safety	0.04	0.06	0.05	0.06	-0.12

SECTION E-E $F = \frac{M_c}{I} = \frac{P \times 6.11 \times 0.935}{0.226} = P \times 25.28$

SUPPORT $F = \frac{M_c}{I} = \frac{P \times 33.92 \times 1.125}{0.876} = P \times 43.56$

SECTION F-F $F = \frac{M_c}{I} = \frac{P \times 3.70 \times 0.928}{0.209} = P \times 16.605$

← WILL FAIL IN BENDING FIRST

MARGIN IS NEGATIVE FOR E-E & F-F, HOWEVER TUBE WILL FAIL IN BENDING @ SUPPORT LONG BEFORE SECTION E-E OR F-F REACH YIELD POINT. ∴ SECTION E-E & F-F ARE ACCEPTABLE,

CP 10.09.13

